

THE
MECHANICS,
MECHANICAL ANATOMY,
AND
MECHANICAL DISTORTIONS
OF
THE BONY STRUCTURE
OF
THE HUMAN FOOT.

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PORTLAND:
PRINTED BY BROWN THURSTON.
1860.

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Entered according to Act of Congress, in the year 1860,

BY J. C. PLUMER, M. D.,

In the Clerk's Office of the District Court of Maine.

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P R E F A C E .

Only the more serious, congenital deformities of the human foot, such as the varieties of CLUB-FOOT, &c., have generally engaged the attention of surgeons. Many of whom of eminence, among them Ferguson, Liston, Druit, Astley Cooper, and others, have alluded to the more important *mechanical distortions*, such as BUNION, SPLAY-FOOT, &c., with suggestions as to the proper surgical treatment required. Sir Benj. Brodie, in his "Clinical Lectures," has devoted an entire chapter to "*corns and bunions*," and their treatment, (*from the works above referred to, Vol. 1, is a compilation*;) but none of them have commenced with the cause of very many of these troublesome distortions, the shoemaker's last. So long as Boots and Shoes are fashioned upon blocks of wood having no features in common with those of the foot, they must, as a matter of course, produce distortions upon the feet of the wearer.

If "the *cut* of a shoe is not, as the cut of a coat, a matter of indifference," most certainly the *form of the last* should not be a subject of fashionable change, especially in its important qualities.

If "when fashion prescribes an arbitrary form of a shoe, she goes far beyond her province, and in reality arrogates to herself the right of determining the shape of the foot," how is it when she prescribes the form and proportions of the last upon which the shoe is moulded?

At present, the *last-maker* produces a *fashionable last*, and from it, the boot-maker a *fashionable boot*, and our feet, alone at fault, in the estimation of both last and shoe-maker, have to suffer; for if the boot is not made to fit the foot, the foot must be made to fit it, and in doing this the foot is distorted.

In order for a boot-maker to have "a really nice perception of what he is to undertake," the *surgical* instrument he is to construct, he should have some knowledge of the anatomical mechanism of the human foot, especially of the solid structure, and should "study the habits of the individual foot, manner of stepping, whether natural and free, or restrained, and whether inward, or outward, or straight-forward.

The line of direction, and distance from the *heel*, of the ball or

joint of the *great toe*, should be carefully considered, for "upon it, the weight of the body turns at every step." And the relation of the corresponding points in the sole of the shoe is important to a firm, elastic, and easy tread, as well as to the economical wearing and comfort of the boot.

That boot and shoe making, and the requirements and abuses of the foot, are subjects upon which the people should be better informed, and upon which more attention bestowed, does not admit of question. A properly constructed boot or shoe is essential to thorough muscular development and health; for without them healthful exercise is tedious, if not impossible.

In distortion of the foot, the Chinese are, as a nation, content with a less degree than ourselves, their idea of elegance requiring but one especial deformity; viz., bending under of the toes against the palm of the foot, for the purpose of shortening it.

We are satisfied with nothing less than a general distortion of the entire foot, in all its joints and throughout its entire construction, and also of the ankle joint.

Dislocation of the great toe joint, or *BUNION*, inversion of the transverse, and flattening of the longitudinal arch, or flat and splay foot, are the degree of distortion required by us, and for the gradual production of which our common shoe is an instrument which cannot be surpassed by any one however ingenious, or whatever his cleverness in mechanics, or knowledge of anatomy.

The object of this pamphlet is to call attention to some of the more important mechanical distortions with a view to the ultimate removal of their cause.

And this is to be accomplished only by the exactions of public sentiment, for so long as the shoemaker receives his accustomed patronage and attending profit, he is satisfied with his own productions, and quite disinclined to the inconvenience of innovations, and substituting other for his own models, simply for the benefit of his patrons; even if he is sufficiently intelligent and unbiassed to appreciate an improvement.

Many of the diagrams are intended exaggerations with the view of rendering the principles involved more appreciable to all.

PART FIRST.

THE

METATARSO-PHALANGEAL,

OR

TRANSVERSE ARCH.

In flattening, or *inversion*, of the transverse arch, as represented in fig. 12, the metatarsal and phalangeal, or, *toe bones*, by gliding down the laterally inclined planes of the *boot-sole*, to the centre C, are approximated or crowded together, producing compression and atrophy of the tissues lying between them, and destroying the elasticity of this portion of the foot. All this is aggravated, as well as the tendency to subluxation, or BUNION, the production of callosities upon the toes, sides, and sole of the foot, especially beneath the joints; by placing the *boot-heel* so far behind, (the line of axis of the TIBIA *a. a. a.*, fig. 1, 2, 3, p. 2nd.) as to throw an undue proportion of the weight of the body upon this portion of the foot, and exert through its wedge or lever effect, (fig. —,) a pushing forward of the foot into the boot or shoe.

(Figs. 1 to 9 inclusive, part 2d.)

TRANSVERSE ARCH.

FIRST.

Of the subluxation of the first METATARSO-PHALANGEAL ARTICULATION; or,

BUNION.

FIG. 1

Represents the outline of the *bony structure* of the natural foot in its integrity, with the bones of each toe in their normal, relative position.

FIG. 2

Represents the outline of the common *boot-sole* "*too narrow and pointed for the part it is to contain.*" (Vol. 1, pp. 4 and 9.)

FIG. 3

Represents the relation of the *narrow and pointed* sole to the *bony structure* of the well formed foot. The effect upon the foot, of wearing which, is seen in

FIG. 4

Outline of the bony structure of the foot distorted by subluxation of the FIRST METATARSO-PHALANGEAL ARTICULATION, or great toe joint, an essential anatomical and mechanical condition of BUNION. (Vol. 1, pp. 7, 9, 11, and 20). Also the cause of "*ingrowing toe nail,*" (Fig. 6, Vol. 1.)

Fig. 1

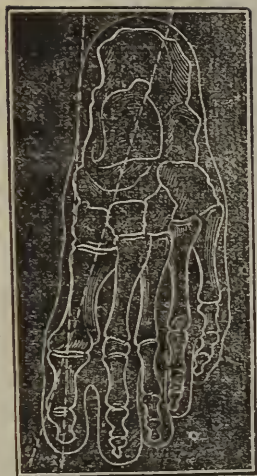


Fig. 2.

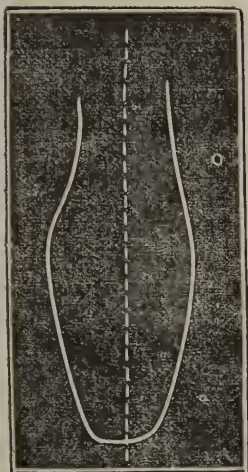


Fig. 3.

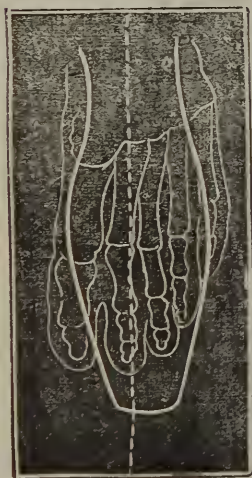


Fig. 4.



TRANSVERSE ARCH.

FIG. 5

Represents a vertical transverse section of the ball portion of the

Common Last,
convex on the under surface,

FIG. 6

Represents a vertical transverse section of the ball portion of the

Patent Last,
concave on the under surface.

FIG. 7

Represents a vertical transverse section of the ball portion of a
boot, from the

Common Last, showing S.,
the sole, *Concave on its upper, and*
Convex on its under surface.

FIG. 8

Represents a vertical transverse section of the ball portion of a
boot from the

Patent Last, showing S.,
the sole, *Convex on its upper and*
flat on its under surface.

Elevation F., fig. 8, affords uniform support to this portion of the sole of the foot, and prevents lateral gliding motion and treading out or inwards of the foot; important to the even and economical wearing of the boot.

(Figs. 9, 10, 11, and 12.)

Fig. 5.

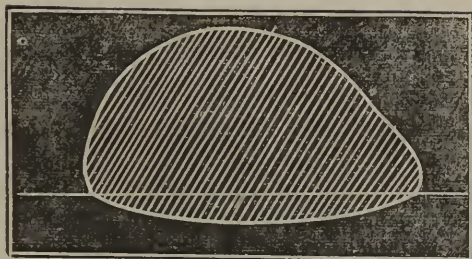


Fig. 6.

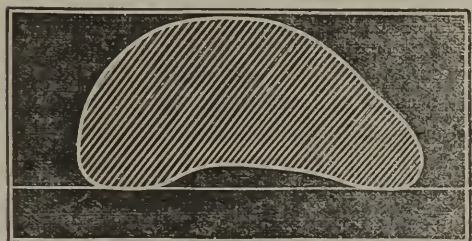


Fig. 7.

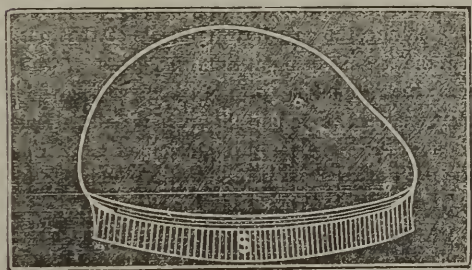
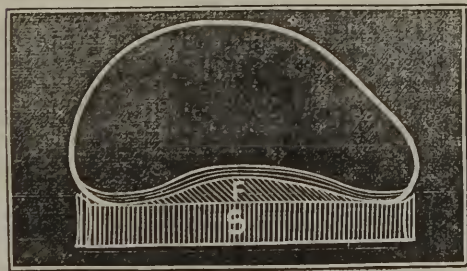


Fig. 8.



TRANSVERSE ARCH.

INVERSION OF THE

METATARSO-PHALANGEAL, OR TRANSVERSE ARCH.

FIG. 9

Represents a vertical transverse section of the natural foot near the METATARSO-PHALANGEAL ARTICULATIONS, or *transverse arch*. B., bony structure; lines a. a. show the arched form of this portion of the foot.

FIG. 10

Demonstrates the adaptation of the *boot sole S. transversely convex* on its upper surface (formed upon the PATENT LAST, fig. 6), to this part of the sole of the undistorted foot, affording uniform support and preventing callosities upon, and distortion of the joints.

FIG. 11

Demonstrates the antagonistic relation of the *boot-sole transversely concave* upon its upper surface, (made upon the common last, fig. 5) to the sole of the well-formed foot. The concave sole is opposed to the *naturally* concave surface of the foot, and the space C. resulting, the only bearing points of that portion of the foot upon the *boot-sole* being at J. J., the joints of the great and little toes; the "breaking in" of the boot, as will be readily comprehended, consists in part, in pressing and flattening the sole S. to the floor F. In attempting this upon a thick, unyielding sole, the parts suffer from undue pressure and become the seat of painful callosities, (Vol. 1, fig. 1, a).

The margins alone of the foot resting upon the *sides* of the concave at J. J., an ellipsis is formed represented by lines L. L. and l. l., the middle portion of the foot being unsupported the unavoidable tendency is flattening, which is represented in

FIG. 12.

FLATTENING OR INVERSION,

of the METATARSO-PHALANGEAL or transverse arch, indicated by the inverted curve, and produced by wearing the unyielding boot-oles formed upon common lasts.

Fig. 9.

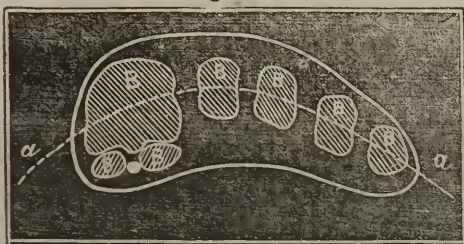


Fig. 10.

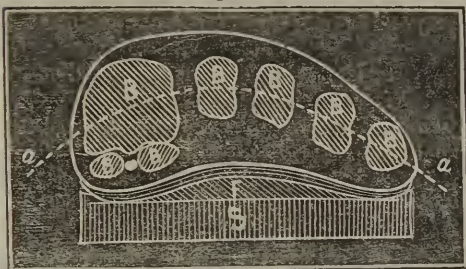


Fig. 11.

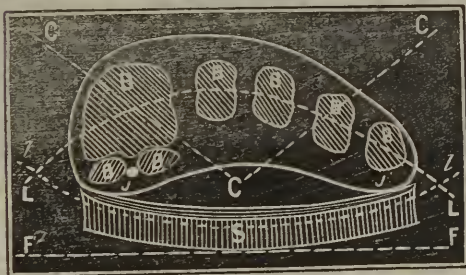
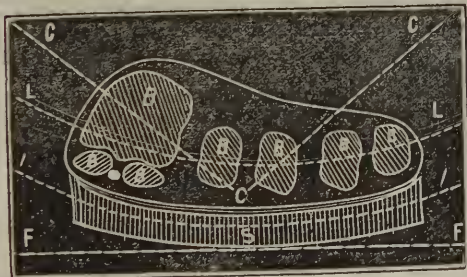
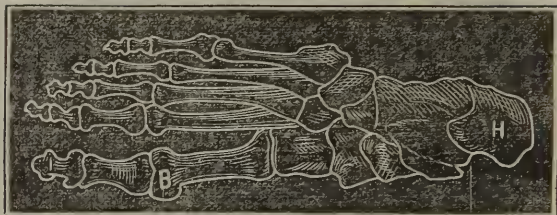


Fig. 12.



TRANSVERSE ARCH.

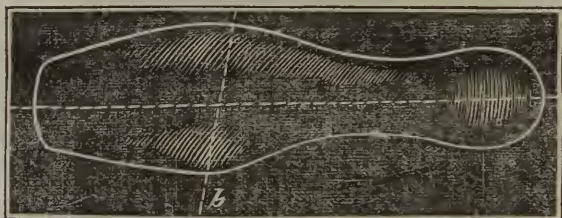
FIG. 13



Represents the outline of the bony structure of the *bottom or sole* of the foot. B, the under surface of the first

METATARSO PHALANGEAL ARTICULATION,
or great toe joint, or ball of the great toe.
 H, the heel.

FIG. 14



Represents the *bottom or sole* of the patent last. The *ball seat b*, corresponding with the point B. in fig. 13, should be properly formed, *well defined*, in the *right direction*, and of *suitable distance*, from the *heel seat H* so as to produce by the aid of the workman's hammer a depression upon the upper surface of the in-sole, which shall correspond with and receive the lower rounding surface of the ball of the great toe, and prevent the necessity of producing the depression with the joint itself, in which consists, in part, the "*breaking in*," of the boot, an efficient auxiliary to the production of Bunion.

This depression is both obvious and palpable, upon the upper surface of a boot sole which has been worn for several weeks, and is produced by the pressure, of the under surface of the great toe joint.

PART SECOND.

THE

CALCANEO-TARSAL

AND

TARSO-METATARSAL,

OR

LONGITUDINAL ARCH.

LONGITUDINAL ARCH.

IN FIG. 1,

The resistance to the breaking tendency of 200 lbs. (*the body, Figs. 4 and 7*), is more effectually resisted, with the support H. (*Boot Heel, Figs. 4 and 7*) situated as in Fig. 1, nearer the line of axis a. a. a. of the super-imposed weight of 200 lbs. (*the body, Figs. 4 and 7*), than it is in

FIG. 2,

Where the support H. (*Boot Heel, Figs. 5 and 8*) is more removed from the line of axis a. a. a. of the super-imposed weight of 200 lbs., (*the body, Figs. 5 and 8*).

The effect of the malposed boot-heel is seen in

FIG. 3,

The structure (*longitudinal arch of the foot, Figs. 6 and 9*), is broken down, the plane of its upper surface (*upper surface of the ASTRAGALUS, Fig. —*), is inclined forward and downward, the weight of 200 lbs. (*the body, Figs. 6 and 9*) is poised forward at an angle with the line of axis a. a. a., taking the direction of the line b. b., (*also Figs. 3, 6, and 9*).

Fig. 1.

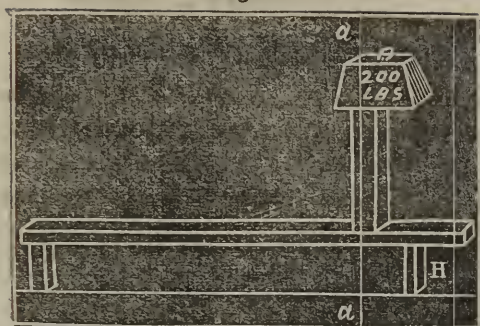


Fig. 2.

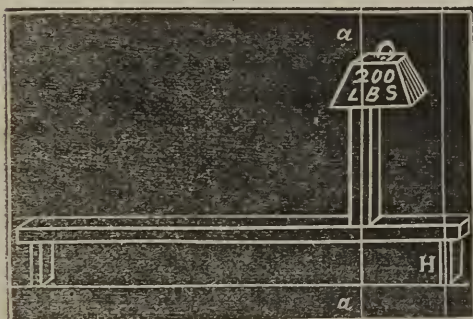
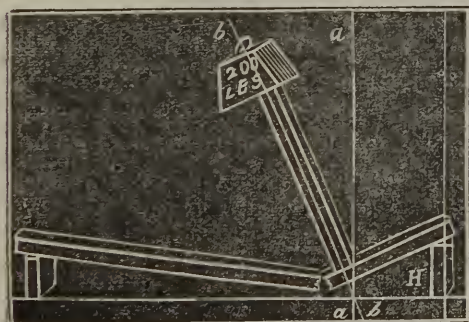


Fig. 3.



LONGITUDINAL ARCH.

FIGS. 4, 5, and 6

Represent the outline of a perpendicular longitudinal section of the *bony structure* of the foot and lower third of the TIBIA or *bone of the leg below the knee*, showing the construction of the CALCaneo-TARSAL, and TARSO-METATARSAL, or LONGITUDINAL ARCH, and in

FIG. 4,

the *proper position* of the boot heel *H* (*support H, fig. 1*), and its relation to the *line of axis A. A. A.* of the TIBIA.

FIG. 5

represents the *malposition of the boot heel H* (*support H, fig. 2*), and its *too remote position, in the rear*, from the line of axis *A. A. A.* of the TIBIA.

FIG. 6

shows the mechanical effect, and to a certain degree, the unavoidable result, of the malposition of the boot heel *H, too remote* from the line of axis *A. A. A.* of the TIBIA, worn off on its *front*, pushed back, and exerting a *wedge or lever effect backward and upward* on the OS-CALCIS or heel bone (*fig. 9*), and a depressing or flattening effect upon the TARSAL ARCH or instep at *I.* in the direction of the double dotted line *H. I.* causing *flat or splay foot* (*fig. 4, vol. 1*), T. TENDO-ACHILLIS or heel cord.

Double dotted lines *L.* represent *ligaments and fascias.*

Fig 4.

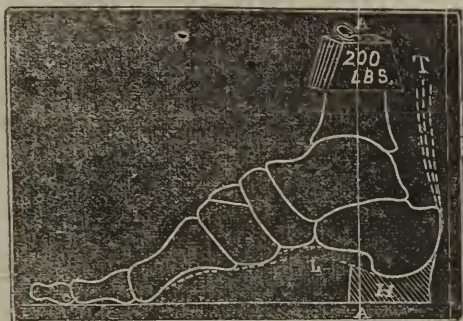


Fig. 5.

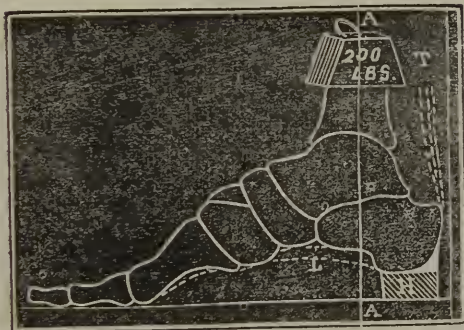


Fig. 6.



LONGITUDINAL ARCH.

FIGS. 7 and 8

Represent the joints J. J. J. of the foot and ankle, as consisting of segments of circles of different diameters. The relation of those in

FIG 7,

Where the arch of the foot, or instep is preserved, as represented by the curve L. L. to those of

FIG. 8,

Where the arch of the foot is broken down, and the instep depressed, as represented by the *reversed or inverted* curve l. l., demonstrates the mechanical changes in the relative position of the bones, constituting the arch of the foot or instep. The *breaking down* of the arch is a essential mechanical condition to the affection known to Surgeons as **FLAT OR SPLAY FOOT**, in which the chord of the arch is distended, and the foot elongated. (Vol. 1, fig. 4).

FIG. 9

Is a representation of a boot worn by an individual suffering from that affection, and which must have been an efficient cause in producing it. A cast of the foot, is preserved, also the boot.—The wedge-shaped form, and position which the heel has assumed will be observed, and wedge or lever effect upon the OS-CALCIS, or heel bone, readily perceptible, and is demonstrated in figs. — and —.

FIG. 10

Represents the outline of properly formed boot sole, and the position of the heel, adopted and worn by the individual referred to.

Fig. 7.

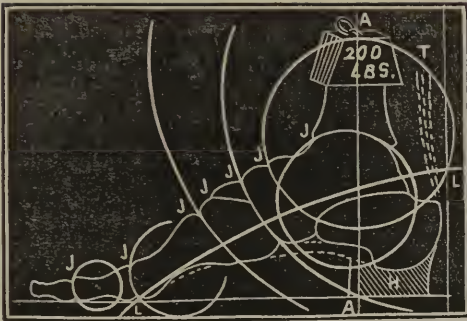


Fig. 8.

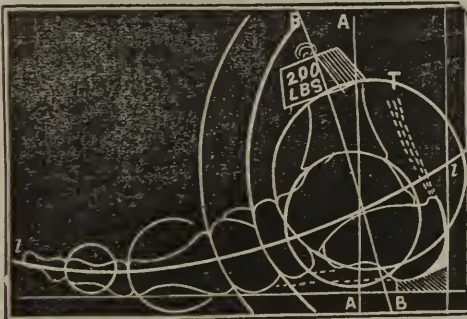


Fig. 9.



LONGITUDINAL ARCH.

DEPRESSION OF THE INSTEP.

FIG. 11

Is a representation of the principles of construction of the arch, a common piece of engineering, applied to the *longitudinal arch of the foot*. A. A. abutments, K. the key stone (ASTRAGALUS), receiving the weight, 200 lbs., (*of the body*), and transmitting it to the others, 1, 2, 3, 5, & H, *representing* the first METATARSAL, CUBOID, SCAPHOID, and OS-CALCIS or *heel-bone*; and H, the *boot-heel*.

FIG. 12

Designed to show the similarity between the construction of the common arch, and that of the *longitudinal arch of the foot*, A. A., abutments; H, the *boot-heel*; K. the ASTRAGALUS (*Key Stone*), upon the upper surface of which the weight of the body (200 lbs), is received and transmitted to the other bones, constituting the longitudinal arch.

FIG. 13

Represents a separation of the abutments, the distance from A to A., fig. 12, being increased to that of B. B., in consequence of which the chord of the arch or *instep*, is distended, the foot flattened, its length increased (fig. 8 and 9,) and the *positions* of the bones changed in relation to the curve L. L. This is a very prevalent mechanical condition of the foot, the result of wearing badly constructed boots.

FIG. 14.

An exaggeration of the preceeding; the abutments being separated still further, to C. C., the chord of the arch becoming still longer, as the distance between the abutments is increased. And the arch or instep is depressed and becomes inverted, as indicated by the inverted curve, L. L., not an uncommon mechanical condition of the foot, popularly known as "*weak ankles*," and to the surgeon as "*SPRAY-FOOT*."



Fig. 11.

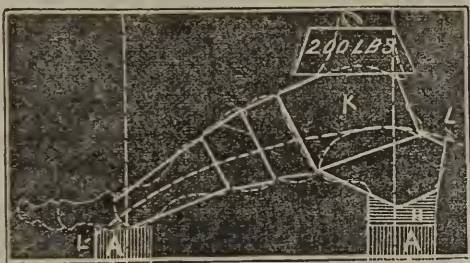


Fig. 12.

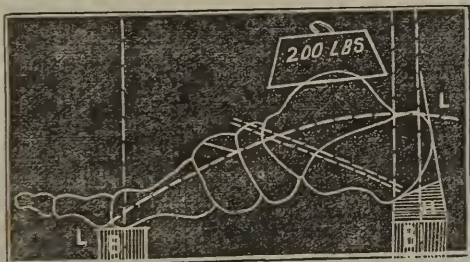


Fig. 13.

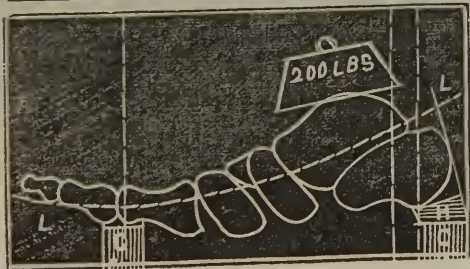


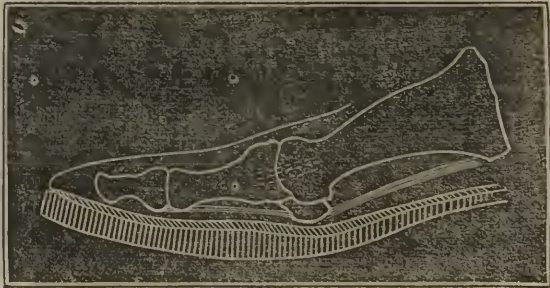
Fig. 14.

LONGITUDINAL ARCH.

FIG. 15

Represents a vertical longitudinal section of the bony structure of the first METATARSO-PHALANGEAL ARTICULATION, or "*great toe joint*," a complicated piece of mechanism, made up off our bones, the first *metatarsal* and *phalangeal*, and two *sesamoid*, analagous to the PATELLA, or, "*knee-pan*." The two former constitute a *hinge joint*, protected upon the lower surface by these sesamoid bones, which form with their fibrous and ligamentous attachments a bedding or foundation, for the reception and support of the rounded head of the first metatarsal bone. Upon this joint the weight of the body turns at every step, and into the depression represented as produced in fig. 14, this bedding is received, and upon which it is supported.

FIG. 15.



IMPROVED LASTS
FOR
BOOTS AND SHOES;
PATENTED JULY 17, 1860,
BY J. C. PLUMER, M. D., PORTLAND, ME.

Selections from the Specification.

"THIS invention has for its object the construction of Lasts for Boots and Shoes in a novel manner, and in such a way that the entire bottom of the Last will correspond to the *bony and ligamentous* structure and conformation of sole, back, and heel of the natural or normal foot, so that a shoe produced upon such a Last will prevent distortions and deformities of the foot or joints of the foot, callosities upon the toes, etc., and *relieve and correct* them where they already exist.

The invention provides for pressing the plantar tissues or cushion of the hollow portion or groove in the arch of the foot, against the metatarsus, causing a separating or spreading effect laterally upon it, thereby preventing compression of the anterior tarsal, metatarsal, or phalangeal bones. It also provides for affording a constringing support around and longitudinally to the arch and sides of the foot, at or under the astragalo and calcaneo-tarsal articulation, or union of the bones of the heel with those of the arch of the foot.

It also provides, by the curved form of the bottom and back part of the heel of the last, for an *advanced position* of the heel of the last, or *heel seat* of the last,—whereby the position of the boot heel is advanced nearer to the front part of the foot, the *shank of the boot is shortened*, and the point of support brought more directly under the line of the tibia, or bone of the leg, rendering a stiff, uncomfortable shank unnecessary.

The shape of the lasts that are at present made, produce in-

boots or shoes made on them, curves, elevations, and depressions that are contrary or antagonistic to the natural conformation of the bony and ligamentous structure of the sole of the foot, which have a decided tendency to deform the foot, and the results are manifested by the deformities, distortions, callosities, &c., that result from this malformation of the soles of boots and shoes that are at present worn. The surface of the innersole is made concave where it should be convex, the heel seat, if there be any, is thrown back too far from the ball portion of the sole, and consequently the axis of the body is brought nearer to the articulation or joint of the anterior with the posterior portions of the tarsal bones, and the weight of the body over this point dislocates, or stretches the bony and ligamentous structure of the arch of the foot, and the chord of the arch is distended and the foot necessarily flattened, and its natural shape and functions seriously injured.

This invention is intended to obviate these objections, and it consists firstly in making the under surface or sole of the last, laterally concave from the front of the heel to the toe of the last.

It further consists in curving the heel portion of the last in such a manner, that a rotundity will be formed corresponding to the posterior extremity of the os-calcis or heel bone with its ligamentous attachments, which will give the heel an advanced position, diminish the length of the shank, and bring the point of support nearer to the line with the axis of the tibia and fibula or bones of the leg, affording ease and giving antero-posterior support to the heel of the foot, and supporting the foot to a great extent at the astragalo and calcaneo-tarsal articulation, as will be hereinafter described and represented.

It further consists in combination with the advanced heel seat in constricting laterally, that portion of the last in the middle of the arch, corresponding to the fleshy portion surrounding the astragalo and calcaneo-tarsal articulation, making it conform and adapting it to this part so as to give a uniform pressure upwards and bi-laterally, as will be hereinafter described and represented."

STATE ASSAYER'S OFFICE, }
Portland, June 15, 1860. }

To Dr. J. C. PLUMER,

My dear Sir :—Several months since, while in the pursuit of my official duties, I had occasion to call at your office. While there, my attention was attracted to sundry diagrams which I saw, and on inquiring their meaning, you explained them, and developed to my understanding an invention of great novelty, and which promised to confer a boon long sought after, but until this never discovered. This was no other than the Last as modified and improved by you, in accordance with an eminently philosophical principle. And when I came to comprehend the invention, it commended itself to my judgment as the only correct plan for the construction of a last, and the making of boots and shoes upon it. So thoroughly confident was I of its entire correctness, that I at once ordered a pair of lasts to be made upon the plan, as designed by you. And without awaiting the result of the experiment, I had my wife and her sister measured also for a pair of lasts each, making three several pairs. The shoes made upon these lasts, were eminently satisfactory. In my own case they were worn with entire ease and comfort, during a recent journey to Washington, and during my stay there and in Baltimore, I walked several miles a day with less fatigue than I ever remember having experienced on walks of similar length before. My wife wore her boots with the greatest comfort, and on temporarily returning to the old style of ladies' boots, was astonished at the difference she found between the new and the old. Her sister who had always been obliged to buy shoes several sizes too long in order to get those she could wear, at length got a boot which fitted her foot, and reduced it to genteel dimensions. In summing up the advantages of the last, or the shoes or boots made upon it, the following

appear to me, evident from my own experience and observation ;

1. An accurate and easy fit.

2. The lines of the last conforming to those bounding the skeleton of a well formed foot, must prevent deformities and appreciably correct them when present.

3. The natural arches of the foot are properly supported, and their development is favored so as to produce a firm and elastic tread.

4. The heel being provided with a hollow seat, where it is firmly set, the foot has not a tendency to slide forward in the shoe or boot, producing pressure upon the nail of the great toe and a liability to the painful disease known as "ingrowing toe nail."

5. No doubt exists in my own mind that some forms of lameness, dependent upon abnormal tension of the ligaments and tissues in the tarsal arch may be effectually relieved by wearing shoes made upon the last as improved by you.

And further experience will no doubt develop further advantages.

In conclusion I would say, that I have reason to believe that the principle suggested to your mind and followed out by careful and patient reasoning and experiment has now for the first time, been PRACTICALLY and FULLY DEVELOPED and APPLIED. It consists as I understand, in conforming the outline of the last to the contour of the osseous and ligamentous tissues of a well formed and developed foot, bringing the point of support more directly in the long axis of the body and limbs, diminishing the amount of leather employed in a shoe to the minimum necessary, and conferring advantages which can be most sensibly appreciated by those who suffer from tender feet.

That you may reap an abundant reward for your careful study and ingenuity is my earnest wish.

Yours very cordially,

H. T. CUMMINGS, M. D.,

Assayer to the State of Maine.

Portland, June 15, 1860.

MR. D. ROBINSON, Jr.,

I have worn with great satisfaction and comfort, the boots furnished by you, and made upon the "Anatomical Last." They were more comfortable to my feet the *first time I put them on*, than a nice pair of boots made upon the common form of last, which I have been wearing for several months.

It seems to me that the invention of Dr. Plumer is as valuable as it is novel. Based upon principles entirely scientific, and applied in a manner quite original, I think his services to the public should be highly appreciated and in some way handsomely rewarded.

Very truly yours, ISRAEL T. DANA, M. D

Portland, Nov. 24, 1860.

DR. J. C. PLUMER,

Dear Sir: — I have been perusing your little book upon the "Mechanics", Mechanical Anatomy, and Mechanical Distortions of the Bony Structure of the Human Foot." By the aid of such numerous and ingenious diagrams, you have made the exposition interesting, clear and conclusive.

I think you cannot fail to reach the *understandings* of the people.

You make your "Patent Last" do what the common last does not begin to do, viz: *correspond to the natural contour of the solid structure of the foot*. Notwithstanding that my feet had so often *ached* in testimony to the fact that new boots even "made to order" upon the old last, would not fit, I would not have believed that the old form of last could be so faulty as the comparison of it with the new has demonstrated it to be.

The *principle* of the "Patent Last" commends itself wholly to my judgment, and I believe it to be as novel as it is excellent.

Boots and shoes made upon it are calculated to *preserve* the natural arches of the foot upon which the facility of standing and walking largely depend, while the use of those made upon the old plan tends to

break them down. I examined the foot of a gentleman yesterday, in whose case the arches had been thus destroyed, and who suffers greatly in consequence. He might have escaped this misfortune had your invention been made fifty years ago. It may do something now to correct the deformity.

It makes the wearing of *thick soles* comfortable to ladies, who have heretofore rejected them to the great detriment of their health.

Boots made upon your Last exert an *equable pressure* upon all parts of the foot, and so must tend to prevent the local congestions and tumefactions so common and so painful, and so often leading to results yet more unfortunate.

A personal *experience* has fully realized high expectations on my part, and such is the universal testimony I have heard from others.

Very truly yours,

ISRAEL T. DANA, M. D.

Portland, Nov. 23, 1860.

J. C. PLUMER, M. D.,

Dear Sir :—It gives me pleasure to add my individual testimony to that of many friends and acquaintances, in regard to your “Patent Anatomical Last.”

Many inventions, which *theorize* beautifully, fall lamentably short in the *practical application*. This discovery is only excelled in the breadth and strict truth of its scientific basis by the thoroughness and success of its practical application; and, indeed, as in the old legend of Columbus and the egg, we only wonder that nobody *did it before*.

It seems to me that a *fair trial* of this last is all that is necessary to convince the most skeptical of its immeasurable superiority to every thing in this line that has preceded it.

Truly yours,

CHAS. W. THOMAS, M. D.

MR. D. ROBINSON, JR.

Dear Sir:—I am happy to say that the boots made for me several weeks since at your establishment, on the Anatomical Last of Dr. Plummer, are the most comfortable I have ever worn.

Yours truly, S. FITCH, M. D.
Portland, Oct. 5, 1860.

Portland, Me., Nov. 23, 1860.

Dear Doctor—

Thank you for your pamphlet on the “mechanics of the human foot.” The diagrams are, in a great measure, new to me and they are very beautiful and very truthful.

Anatomists have long admired the skeleton of the foot, and Surgeons have carefully analyzed the principles of its construction and the relation of its parts in order, to remedy its frequent distortions and diseases induced by fashionable boots and shoes.

But the idea of conforming the Last to the solid structure of the foot upon the principles of exact science (unquestionably originated by yourself) is destined to revolutionize completely the art of boot making and elevate it, if not to the rank of the fine arts, at least to that of the finest decorative arts.

The important changes you have instituted in the construction of the Last, are calculated not only to avert the evils named above, but by preserving the integrity of the arches of the foot will eminently develop its beauty, strength, elasticity—and these results will induce many to walk much in the open air, who seldom walked before, especially the ladies, and thus an important means of health will become attractive, interesting, fashionable, and consequently universal.

I have had another pair of boots made on the anatomical lasts, and I shall probably never again habitually wear any other kind.

I formerly remembered my Edinburgh shoes with which I walked over the Highlands of Scotland as most comfortable, and the boots made for me in Paris as very

beautiful, but those made upon the anatomical lasts are alone perfect, and with sentiments of real gratitude for the benefits of your invention, I remain

Yours very truly,

Dr. J. C. PLUMER.

S. FITCH, M. D.

Portland, Dec. 7, 1860.

Dear Doctor :—

Permit me to give you my experience in the use of the "Anatomical Last." Since childhood I have suffered from weakness of the ankles, and flattening of the foot, much aggravated by a recent attack of Rheumatism, that left the ligaments so sore as to render walking extremely painful, even in boots which I have worn so long as to fit them as perfectly to the feet as it is possible for boots, made on the old last. In this condition I tried a pair of shoes constructed on the Anatomical Last. I was able to walk in them with the utmost ease. The peculiar form of the sole and heel afforded that support to the plantar arch which it had always needed, and in a short time my feet were in a better condition than they had ever been before.

I most cordially and gratefully acknowledge the benefit which I have received from their use, and shall take every possible occasion to recommend the Anatomical Last to all who, from any cause, find it difficult to get well fitting and easy boots, certain that, after a sufficient trial, they will agree with me in the belief that it is one of the most valuable and useful inventions of the times. I do not hesitate to predict, that it will entirely supersede the use of the old last in no great length of time.

Yours very truly,

W. R. RICHARDSON, M. D., *City Physician.*

J. C. PLUMER, M. D.

From the Portland Advertiser, Oct. 25, 1860.

"WHERE THE SHOE PINCHES."

Our attention has of late been frequently called to various articles published in the papers of New York and elsewhere, upon the subject of shoes, based upon a book recently published in Germany by Professor Meyer. This author is of the opinion that a vast deal of human suffering might readily be saved, if the teachings of nature and the truths of science were attended to in making clothing for the feet. Corns and bunions are works of art, not of nature, and fashionable boot and shoe makers are the artists. From the New York Evening Post, one of the most influential and careful papers in the country, we extract the following paragraphs:

"Dr. Meyer, the author, is pronounced one of the highest continental authorities on Physiological Anatomy, who has published an important general text on that science, as well as several treatises on the structure of the foot and knee. Certainly the needless sufferings which men and women endure from badly cut and ill-shaped shoes cry aloud for a reform.

Against the prevailing pattern Professor Meyer, in his capacity of anatomist, utters an earnest protest. The cut of a shoe, says the Professor, is not as the cut of a coat, a matter of indifference. "*When Fashion prescribes an arbitrary form of shoe, she goes,*" he asserts, "*far beyond her province, and in reality, arrogates to herself the right of determining the shape of the foot.*"

In his opinion the shoemaker ought not only to produce a shoe that does not pinch, but a shoe so constructed that it will give to a foot distorted by the pinching it has borne already, fair chance of a return to its right shape, and full possession of its power as a means of carrying the body onward. He tells us that, in measuring a foot for shoe or boot, the first thing to be considered is the place of the great toe. Upon this toe, in walking, the weight of the whole body turns at every step.

The practice adopted by many of having a last made of the exact size and model of the foot is condemned by Professor Meyer, if the foot has been previously injured in consequence of wearing ill fitting boots or shoes. If a cast be made of a distorted foot and a boot fitted to that, it is bad, because thereby the distortion is confirmed. It would be much better, therefore, says the Professor, so to form the boot that the conditions of healthy walking are allowed for, and the bones, at least to some extent, can gradually right themselves. To a foot shortened by distortion he would fit a shoe adapted to its healthy size.

The subject which has attracted the attention of the German Professor and which is of sufficient practical importance to engage the attention of every one who does not avoid all the discomforts of corns and bunions and distortions generally, by going

barefoot, has been made a special study by one of our own townsmen, who, going further than Professor Meyer, has attempted to perfect a plan for furnishing a boot which shall be elegant in shape while it perfectly conforms to the anatomy of the foot. That the foot was constructed with a view to locomotion is apparent to everybody excepting fashionable shoemakers. In the scheme of Dr. Plumer of Portland, this fact is kept constantly in view. Many of our best known citizens are now wearing boots or shoes constructed upon Dr. Plumer's lasts, and under his superintendence, and they are unanimously of the opinion, that for real use, comfort, and elegance, they are vastly superior to anything which can be made upon the ordinary plan. We append a few extracts from the preface of a pamphlet about to be issued by Dr. Plumer, with the intention of again referring to the subject.

"At present the *last-maker* produces a *fashionable last*, and from it, the boot-maker a fashionable boot, and our feet alone at fault, in the estimation of both last and shoe-maker, have to suffer, for if the boot is not made to fit the foot, the foot must be made to fit it, and in doing this the foot is distorted.

In order for a boot-maker to have really a nice perception of what he is to undertake, of the *surgical* instrument he is to construct, he should have some knowledge of the anatomical mechanism of the human foot, especially of the solid structure, and should study the habits of the individual foot, manner of stepping, whether natural and free, or restrained, and whether inward, or outward, or straight-forward.

The line of direction, and distance from the *heel*, of the ball or joint of the *great toe*, should be carefully considered, for upon it, the weight of the body turns at every step. And the relation of the corresponding points in the sole of the shoe is important to a firm, elastic, and easy tread, as well as the economical wearing of and comfort of the boot.

That boot and shoe making, and the requirements and abuses of the foot, are subjects upon which the people should be better informed, and upon which more attention should be bestowed, does not admit of question. A properly constructed boot or shoe is essential to thorough muscular development and health; for without them healthful exercise is tedious, if not impossible.

* * * * *

In distortion of the foot, the Chinese are, as a nation, content with a less degree than ourselves; their idea of elegance requiring but one especial deformity, viz., bending under of the toes against the palm of the foot, for the purpose of shortening it. We are satisfied with nothing less than a general distortion of the entire foot, in all its joints and throughout its entire construction."

Gentlemen (and ladies ?) who have pet corns and other pedal grievances, will be delighted at the publication of a work called, " Why the Shoe Pinches," and in which the author, Prof. Meyer, shows boots and shoes are almost invariably ill-shaped, and that beside the crippling deformities more immediately attributed to them, they cause indirectly many injuries to health which are commonly imputed to any cause but the true one.

Professor Meyer builds up his argument on this fundamental principle, that the shape of the shoe ought not to be left to the dictates of fashion, for that would be in fact giving to fashion the right of determining the shape of the foot, it being quite clear that if the shoe differ in shape from the foot, the latter being the more pliable, must of necessity, adapt itself to the shape of the former. He maintains that the great toe plays by far the most important part in walking ; that in easing the foot, in the act of stepping, the whole of the sole is gradually unrolled, as it were, up to the point of the great toe ; and that the line in which the foot thus unrolls itself passes through the center of the heel, and is in a perfectly sound foot, continuous with the axis of the great toe. In such a foot, also, toes lie in an almost rectangular triangle, whilst one of the commonest distortions caused by shoes and boots of the usual form is the conversion of the rectangular into an isosceles acute angled triangle. Growing-in-nails, gout, chilblains, corns, bunions, and flat foot are among the other evils immediately springing from the same cause. *It is a prevailing belief among shoe-makers that there are primary differences in the structure of the feet : but this is an error. All feet are perfectly alike in the principles of their mechanical construction, and the only differences in our healthy feet are those arising from varying length and breadth.*

In this connection we would call attention to the *Anatomical Last*, patented by J. C. PLUMER, M. D. The peculiarity of this last is that it is conformed to the contour of the body and ligamentous structure of the sole and sides of the normal foot, and rotundity of the back part and sides of the heel when elevated. This is pronounced by surgeons and scientific men generally, a novel and scientific principle

From this Last not only a comfortable, but an *elegant fitting* boot is produced, one which requires no " *breaking in*." And it is claimed that for the relief of *tender feet, inflamed instep or joints*, or callousities upon any part of the foot, for the preservation of the natural circles of the foot, insuring freedom from the usual tire-some, straining sensations in standing or walking, and a firm and elastic tread, for the prevention and correction of mechanical distortions, consequent upon wearing badly constructed boots. Nothing equals boots and shoes made from this Last.

Judging from the number and character of the testimonials published by the proprietors, the " *patent last* " has already become the favorite. It is now in use by all the most intelligent boot makers in this and other cities, and important towns, throughout the State, and will very soon come into general use.—Portland Transcript.

From the Eastern Argus, Aug. 15, 1860.

IMPROVED LASTS FOR BOOTS AND SHOES.—We would invite attention to the improved last for boots and shoes, recently patented by J. C. Plumer, M. D., of this city. The inventor claims that it is “constructed in accordance with the *bony* and *ligamentous* conformation of the *bottom* and back part of the foot, *when the heel is elevated*, and that boots and shoes made from it will not only *prevent*, but *correct* deformities already existing.”

It is apparent to the most casual observer that a large proportion of persons, resident particularly in cities, are suffering from distortions and deformities of the feet, the result, in many instances, of wearing, from early life, ill-fitting, and badly constructed boots or shoes. The usual shape of the last upon which they have heretofore been made has not corresponded with that of a well-formed foot. Last makers seemed to have directed their attention simply to changes in the fashion of the *upper* and *front part*, comparatively as unimportant as the back of a glove, entirely disregarding the conformation of the foot, and more especially, the sole, the most important part of it.

The shape of the lasts that are at present in general use, says the inventor of the improved last, produces in the *soles* of the boot or shoe made upon them, curves, elevations, and depressions that are opposed to the natural conformation of the *bony* and *ligamentous* structure of the *sole of the foot*, which have a decided tendency to deform the foot while young, and the results are manifested by the distortions and callosities so generally prevalent in consequence of the ill-shaped shoes at present generally worn.

The idea of conforming the last to the *fleshy structure* of the foot is erroneous, since it depends much upon circumstances, certain portions of the foot, especially the *fleshy portion of the longitudinal arch*, becoming like the workman's arm, enlarged by over straining.”

We are informed by the proprietors, that during their experiments for the past few months, several hundred persons have been fitted, and judging from the number and character of the testimonials before us, the matter

is no longer an experiment but a decided success; and that public sentiment will compel the general adoption of the improved last. It is peculiarly important for the young and for those who have the muscles of the feet debilitated from any cause. In such cases the advantages are soon manifest. Feet that are strong and hard may resist the bad effects for a long time, but the continual pressure will finally tell upon the firmest feet, as how many enlarged joints and other distortions will testify. We are right glad to see this improvement. It is based on scientific principles, and we commend it to the attention of all who wish comfortable boots for themselves, and desire their children to grow up with symmetrically shaped feet.

From the Boston Evening Gazette.

WHY THE SHOE PINCHES.—A professor of Anatomy in the University of Zurich, Prof. Meyer, has lately given his attention to a most practicable subject,—why shoes pinch,—a subject on which the disciples of St. Crispin have from time immemorial claimed the exclusive right to judge, even extending their claim to the primary question *whether in fact our shoes do pinch at all*. Professor Meyer has taken the matter up as an anatomist, and a young Edinburgh physician has translated his pamphlet.

As reported by the New York Evening Post, he starts with the fundamental idea that fashion ought to take the cut of the shoe from the form of the foot, and not cramp the form of the foot to suit the cut of the shoe. The first thing, he says, is to consider the great toe, which does most of our walking for us. A line from the point of this toe to the middle of its root would, he says, if continued, pass the middle of the heel; but as boots and shoes are made, the tendency is to twist the toe out of this line. Therefore he claims that the shoe should be made to suit the natural position of the great toe as well as the little toe (which has hitherto had a disproportionate share of the attention of mankind); boots, he says, if made on principle, ought to be so shaped that when a pair are side by side, with the heels in contact, the inner line of the front part of the soles should also be in contact along the whole edge to the end of the great toes, so that if the toes are to be pointed, this must be done by taking away from the outside alone.

Professor Meyer admits that boots made in this way would give us all the appearance of turning in our toes, but concludes that as this is the natural shape of the foot, it must be as elegant in reality as any other shape, besides being more comfortable.

We noticed, a few weeks since, the improved last recently patented by J. C. Plumer, M. D., of this city, and assure the Gazette that from this last not only a comfortable but an elegant boot can be produced. We speak from personal examination and experience in this matter, and are gratified to notice that the same subject has attracted attention in Europe. It is high time. The inventor of this last claims that it is constructed in accordance with the *bony and ligamentous conformation of the sole and back part of the foot* when the heel is elevated, and that boots and shoes made upon it will not only prevent deformities, but correct those already existing, and we think it will do so.—*Eastern Argus*, Oct. 15, 1860.

From the Newburyport Herald of Gospel Liberty, Oct 4th, 1860.

IMPROVED LASTS FOR BOOTS AND SHOES.—We would invite attention to the improved last for boots and shoes, recently patented by J. C. Plumer, M. D., of Portland, Me.

The inventor claims that it is "constructed in accordance with the *bony and ligamentous* conformation of the *bottom* and back part of the foot *when the heel is elevated*, and that boots and shoes made from it will not only prevent but correct deformities already existing."

The shape of the lasts that are at present in general use, says the inventor of the improved last, produces in the soles of the boot or the shoe made upon them, curves, elevations, and depressions that are opposed to the natural conformation of the *bony and ligamentous* structure of the *sole of the foot*, which have a decided tendency to deform the foot while young, and the results are manifested by the distortions and callosities so generally prevalent in consequence of the ill-shaped shoes at present generally worn.

The idea of conforming the last to the *fleshy* structure of the foot is erroneous, since it depends much upon circumstances, certain proportions of the foot, especially the *fleshy portions of the longitudinal arch*, becoming like the workman's arm, enlarged by over-straining.

From the same, Oct. 11.

PORTLAND, Oct. 4th, 1860.

BROTHER CARTER.—I see in this week's paper that you notice Dr. Plumer's improved last for boots and shoes. I will say to all whose feet have been tortured with the old style, that I have tried the new and found relief. And I hope for humanity's sake it may soon take the place entirely of the old style. Why should the feet which God has made, be so tired and suffer so much? Why should they be more weary than other parts of the body? Only because for generations a shoe of Chinese folly has been worn. The price of the new is a half dollar more than the old style. I write this unsolicited, and have no interest in the matter, only as I wish success to everything which gives relief. The attention of all who manufacture shoes is called to this very useful improvement. It will doubtless be for their interest, for where the new style is known, it must take the place of the old.

O. P. TUCKERMAN.

PORTLAND, July 12, 1860.

DR. PLUMER,

Dear Sir :—Having learned the principles upon which your “Anatomical Last” is made, I was favorably impressed as to its efficiency in relieving a difficulty which we all have experienced, who have to walk considerably, viz : severe pain in the feet after much walking. After having worn the boots made upon the “Anatomical Last,” I found my anticipations more than realized. I can walk nearly all day without experiencing the above-named difficulty in the least degree. I also escaped the torturing process of *breaking in* my boots, for they were as easy at first as after they had been worn.

Truly yours,

C. H. BURBANK, M. D.
Corner of Congress and Temple Streets.

ROXBURY, Sept. 18th, 1860.

D. ROBINSON, JR. Co.,

GENTLEMEN:—I am very much pleased with the shoes I had made for myself and my son, from Dr. Plumer's Patent Last, and I propose to send for more soon.

Your obedient servant,

D. G. HASKINS.

From Professor Packard, Brunswick College.

BRUNSWICK, Nov. 5. 1860.

MESSRS E. SHAW & Co.,

GENTLEMEN:—The Shoes were received, and proved, an excellent fit. I never had new shoes so comfortable, and judge that the *Anatomical Last* is the one for me.

Respectfully yours,

A. S. PACKARD.

Figure 3.



Figures 3 and 4, perpendicular line, for the use of foot and boot; B, bony structure; C, bony portion; Dark lines, section of foot.

ANATOMICAL LAST,

PATENTED JULY 17, 1860.

Constructed in accordance with the **BONY AND LIGAMENTOUS CONFORMATION OF THE BOTTOM OF THE FOOT**, and of the **ROTUNDITY** of the **SIDES** and **BACK PART OF THE HEEL** WHEN ELEVATED. In the **COMBINATION** of the **ELEVATED AND ADVANCED POSITION** of the **HEEL SEAT** with the **HOLLOW** and **CONSTRUCTED SHANK** and **SOLE**, an entirely new principle is involved, which constitutes a decided improvement in Lasts for Boots and Shoes.

From this Last a boot or shoe is made very much shorter on the *sole* than that from the old style, in consequence of the shortening of the shank, and the advanced position of the heel seat, insuring a degree of tolerance in fit unattainable by those made upon any other last; and for tender or injured feet, for persons suffering with corns or bunions, or a depressed instep, or from **DISTORTION OR DEFORMITY OF THE FEET**, of any kind, and for preventing inequalities and injuries, no last has ever been produced that meets the case like this.

Figure 4

